



Profile Similarity Metrics Increase Personality Scale Validity

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15 April 2016

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Personality Tests



- Modest scale validity & minor adverse impact
- Scale scores often computed as the mean item rating with some item ratings corrected for directionality.
 - Pursue physical activities: non-reversed (straight) coded
 - Avoid Physical Activities: reversed coded
- **Research Goal – Explore use of Profile Similarity Metrics (PSMs) and Consensual Standards to increase scale validity**



Personality Tests & Distance Metrics



- Conventional and distance scores are redundant: $r = -1.00$

Fitness Motivation	Rating	Conventional Score	Key	Distance Score	Sum
Non-reversed Items: “Like to exercise...”	1	1	5	4	5
	2	2	5	3	5
	3	3	5	2	5
	4	4	5	1	5
	5	5	5	0	5
Reversed Item Scores “Like to watch TV...”	1	5	1	0	5
	2	4	1	1	5
	3	3	1	2	5
	4	2	1	3	5
	5	1	1	4	5

➤ Suggests PSMs may increase scale validity



D² and Shape



- Conventional D² formula:

$$D^2 = \sum (X_i - K_i)^2 / n \text{ for item } i = 1 \text{ to } n \quad (\text{Eq 1})$$

where X_i and K_i correspond to observed ratings/values from response profile, X , and the scoring key, K , for item i

- Statistical substitutions for sd_x^2 , sd_k^2 , and r_{xk} , provide: (Eq 2)

$$D^2 = \Delta_{\text{Elevation}}^2 + ((n-1)(sd_x^2 + sd_k^2 - 2sd_x sd_k r_{xk})) / n$$

where $\Delta_{\text{Elevation}} = X_{\text{mean}} - K_{\text{mean}}$

- PSMs:

- Shape = $r_{x,k}$
 - Delta = $\Delta_{\text{Elevation}}^2 = (X_{\text{mean}} - K_{\text{mean}})^2$
 - Scatter = sd_x^2
 - Elevation = X_{mean}
- }

Keyed
- }

Descriptive



Research Design



- **Analyze personality data used to award ROTC scholarships (i.e., two years of operational data)**
 - Cadet Background Experience Form (CBEF): 91 items
 - Sample size by scale ranged from 783 to 1786 because scale content changed over years
- **Longitudinal Design: Validated measures against 2nd-year program disenrollment (reversed continuance)**
- **Design Constraints/Threats**
 - Scales were not developed for PSM analyses
 - Some scales do not have reversed items
 - Not all scales predict disenrollment
 - Disenrollment is a low probability event ($p = .16$)
 - Validated personality data from high school students (grades 11 & 12) against program disenrollment (university year 2)



Expectations & Hypotheses



- PSMs account for most of the variance in Conventional/distance scores: $R^2 > .90$
- PSMs computed with the conventional key will increment the prediction of distance scores.
- Consensual scoring standards may enhance scale validity



CBEF Scales



Ratio: "Reversed" to All items	Scale	Definition
2/4	Igoal	Goal Orientation
3/8	PWP	Past Withdrawal Propensity
3/8	FM	Fitness Motivation
2/6	IntLd	Interest In Leadership
2/7	Lie	Social Desirable Responding
2/8	ES	Equity Sensitivity
1/5	TFI	Tolerance for Injury
1/8	Manip	Manipulativeness
1/11	ST	Stress Tolerance
1/14	AI	Army Identification
0/6	SE	Self Efficacy
0/6	PrLd	Peer Leadership
0/9	Ach	Achievement
0/4	Cch	Coaching
0/4	Hst	Hostility to Authority



Distance Scores Regressed on PSMs



- PSMs account for nearly all distance score variance
 - Primarily shape and scatter when item ratios > .25
 - Primarily elevation when item ratios < .25

Scale (Item Ratio)	R	β -Shape	β -Scatter	β -Delta ²
IGOAL (2:4)	.94	-.94	.07	.05
PWP (3:8)	.99	-.44	.70	.19
FM (3:8)	.99	-.48	-.59	.13
IntLd (2:6)	.98	-.34	-.73	.10
LieCon (2:7)	.91	.02	.90	.05
ES (2:8)	.99	-.45	.40	.41
TFfI (1:5)	.96	-.52	-.28	.44
Manip (1:8)	.99	-.30	.20	.70
ST (1:11)	.98	-.32	-.14	.75
AI (1:14)	.97	-.40	-.08	.62

Model Statistics: (df = 3, 776-1782), (All F-statistics > 2361.733), all models and coefficients significant unless otherwise indicated.

Lie Conventional is scored dichotomously.



Incremental Validity of PSMs Over Distance Scores on Disenrollment



- Documented potential validity gains:
 - 3 of 4 conceptually relevant scales
 - 4 of 10 scales with reverse items

Scale	Hierarchical Analysis				PSM Model		PSM Model Coefficients					
	R	R	R ²	Sig	R	Sig	Shape		Scatter		Delta ²	
	Dist Step 1	PSMs Step 2	change	F change		F change	β	p	β	p	β	p
IntLd	.01	.14	.020	.001	.14	.001	-.130	.002	.124	.003	.073	.060
AI	.06	.12	.011	.001	.09	.002	-.021	ns	.032	ns	.078	.026
Manip	.04	.11	.011	.014	.09	.038	-.009	ns	.081	.015	-.077	.104
Lie	.07	.09	.005	.061	.09	.003	.052	.074	.066	.005	-.016	ns

- No significant gains for FM, Igoal, PWP, ST, TFI, & ES



Understanding Gains



- Distance scores represent poorly weighted composites to predict continuance
 - Compare regression equations for Distance versus Disenrollment on PSMs

Scale	Outcome	PSM Model Coefficients			
		R	β -Shape	β -Scatter	β -Delta ²
IntLd	Disenroll	.15	-.13	.12	.07
	Distance	.98	-.34	-.73	.10
AI	Disenroll	.13	-.02	.03	.08
	Distance	.97	-.40	-.08	.62
Manip	Disenroll	.12	-.01	.08	-.08
	Distance	.99	-.30	.20	.70
Lie	Disenroll	.10	.05	.07	-.02
	Conventional	.91	.02	.90	.05



Incremental Validity of Consensus Distance Over Simple Distance



Scale	Hierarchical Analysis				Distance Loadings			
	R	R	R ² change	Sig F change	Simple		CBA	
	Simple D Step 1	Consensus D Step 2			β	p	β	p
PrLd	.02	.14	.019	.001	-.04	ns	.139	.001
IntLd	.02	.15	.022	.001	-.01	ns	.151	.001
AI	.06	.11	.008	.001	.02	ns	.101	.001
Ach	.02	.05	.002	.056	-.01	ns	.05	.056

- Suggests potential validity gains for the **Peer Leadership Scale**
- Consensus validity gains for the Interest in Leadership and Army Identification do not increment the PSM models for those scales



Conclusions/Questions



- Modest validity gains using PSMs and consensual standards to score conventional personality scales
 - Distance scores represent poorly weighted PSM composites
 - Design weaknesses may minimize gains
- Larger gains for conceptually relevant scales:
 - Interest in Leadership
 - Peer Lead
 - Army Identification
 - Lie

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-0188	
1. REPORT DATE (DD-MM-YYYY) April 2016		2. REPORT TYPE Final		3. DATES COVERED (From - To) April 2015 – August 2015	
4. TITLE AND SUBTITLE Profile Similarity Metrics Increase Personality Scale Validity				5a. CONTRACT NUMBER W5J9CQ-11-C-0040	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER 622785	
6. AUTHOR(S): Peter J. Legree, Robert N. Kilcullen, Kristin Repchick				5d. PROJECT NUMBER 311	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U. S. Army Research Institute for the Behavioral & Social Sciences 6000 6 TH Street (Bldg. 1464 / Mail Stop 5610) Fort Belvoir, VA 22060-5610				8. PERFORMING ORGANIZATION REPORT NUMBER N/A	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) U. S. Army Research Institute for the Behavioral & Social Sciences 6000 6 TH Street (Bldg. 1464 / Mail Stop 5610) Fort Belvoir, VA 22060-5610				10. SPONSOR/MONITOR'S ACRONYM(S) ARI	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S) N/A	
12. DISTRIBUTION/AVAILABILITY STATEMENT: Distribution Statement A: Approved for public release: distribution unlimited.					
13. SUPPLEMENTARY NOTES ARI Research POC: Dr. Peter J. Legree, Personnel Assessment Research Unit. Conference paper and poster delivered at the 2016 SIOP Conference in Anaheim, California.					
14. ABSTRACT Personality and temperament scales are used in employment settings to predict performance because they are generally valid and reduce adverse impact. This research investigates the use of Profile Similarity Metrics (PSMs) in place of conventional, distance-based scores to improve the predictive validity of personality and temperament scales against job continuance outcomes. Analyses documented that: PSMs consistently accounted for over 90% of the variance in personality and temperament scales computed using conventional metrics; the optimal weighting of PSMs provided incremental validity gains over conventional scores for four of the ten scales; and the use of a consensual scoring key provided incremental gains over the use of a conventional scoring key for four of the fourteen scales. Implications are discussed. Includes PowerPoint poster presentation (12 slides). Presented at the 2016 SIOP Conference in Anaheim, California, April 14-16, 2016.					
15. SUBJECT TERMS Personnel Selection, Profile Similarity Metrics, Temperament, Personality					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT Unclassified	b. ABSTRACT Unclassified	c. THIS PAGE Unclassified	Unlimited Unclassified	13	Dr. Tonia Heffner
					19b. TELEPHONE NUMBER (703) 545-4408

